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ABSTRACT

This paper describes an interdisciplinary project at California State University (Long Beach) designed to increase the attractiveness of the geosciences to underrepresented groups. The project is called the Geoscience Diversity Enhancement Project (GDEP). It is a 3-year program which began in the fall of 2001 with funding from the National Science Foundation (NSF). The project's purpose is to attract NSF-defined science, technology, engineering, and mathematics minorities in local community colleges and high schools into the geosciences through an intensive summer research experience at California State Long Beach. The geosciences are defined as physical geography, geology, archaeology, and environmental science. An important aspect of GDEP is assessment of the degree to which it accomplishes its goals. To establish a baseline of general education student perceptions of the geosciences, surveys were distributed to sections of each department's basic general education science course. The survey consists of 25-30 questions to be answered along 1-5 point Likert scales ranging from strongly agree to strongly disagree. Results remain disappointing. At this stage, 60% of student pre-test responses diverged significantly from neutral, with positive and negative divergences roughly equal at 32% and 28%, respectively. In the post-tests only half diverged significantly from neutral. In all, student perceptions basically became overall more neutral. (BT)

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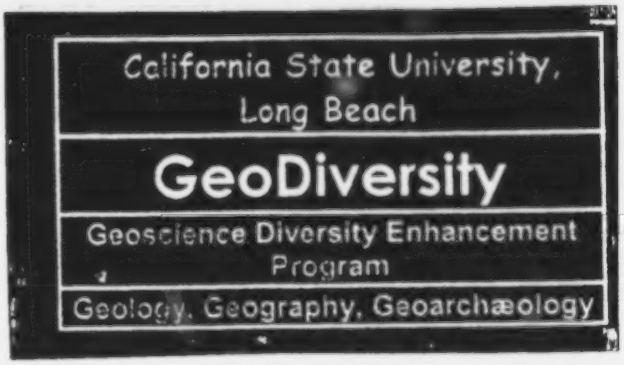

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[Attachment 1]

Geoscience Diversity Enhancement Project: Student Responses

Association of American Geographers
New Orleans, 5 March 2003

Geoscience Diversity Enhancement Project

A collaboration of the departments of:

Geography, Geological Sciences, and Anthropology
California State University
Long Beach, CA 90840

Introduction

This paper describes an innovative interdisciplinary project at California State University, Long Beach, which is designed to increase the attractiveness of the geosciences to underrepresented groups. The program is called the Geoscience Diversity Enhancement Project, or GDEP. [Attachment 2] This is a three year program, which began in the fall of 2001, with funding from the National Science Foundation's Opportunities to Enhance Diversity in Geosciences program. The purpose of this $852,000 project is to attract NSF-defined Science, Technology, Engineering, and Math minorities in local community colleges and high schools into the geosciences through an intensive summer research experience at California State University, Long Beach. The geosciences are defined as physical geography, geology, archaeology, and environmental science.

[Attachment 3] GDEP represents a uniquely harmonious team effort among faculty investigators in the departments of Geography, Geological Sciences, and Anthropology. At CSULB these three departments are housed in two different colleges, the College of Liberal Arts (where Geography and Anthropology are based) and the College of Natural Sciences and Mathematics (where Geological Sciences can be found). In addition, GDEP includes a faculty member from the Department of Psychology, who serves as a program evaluator,

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and a staff member from the Student Access to Science and Math Center, who manages the community college and high school students brought to CSULB as GDEP interns and Foundation employees. These interns are nominated by five local community college partners and the Long Beach Unified School District. GDEP, then, requires rather elaborate institutional support and coordination in order to carry out its interdisciplinary and outreach goals. Above all, GDEP is committed to closing the gap between community demographics and the CSULB student deomographics in the three geoscience disciplines. [Attachment 4] This table shows the disconnect between community and geoscience demographics that led to this effort to intervene.

GDEP Goals

[Attachment 5] The goals of GDEP are to increase the number of underrepresented students who have had educational and research experiences in the geosciences. GDEP is meant to establish a seamless transition of underrepresented students in local community colleges and high schools into four-year universities in general and CSULB in particular. GDEP systematically increases the visibility of geography, geology, and archaeology in local community colleges and high schools, particularly emphasizing the exciting fieldwork common in those disciplines, the many attractive jobs available in them, and the kinds of educational preparation students need to be competitive for those jobs and further studies. GDEP does this, not only through its summer student research immersion experience but through campus visits by CSULB GDEP faculty and staff. An additional goal is to increase GDEP faculty research output and involve community college and high school faculty in this research. This is meant to improve the level of geoscience education in all our classes and thereby increase the attractiveness of the geoscience majors to non-GDEP students in our courses. The hope is that underrepresented students will not only transfer to CSULB or other four year institutions but will major in one of the geosciences and retain their interest through graduation, if not graduate school.

GDEP Operations

[Attachment 6] Each summer, the CSULB GDEP faculty loosely define field and lab based research projects and then refine them with their community college and high school faculty collaborators. The assessor, too, runs a survey and focus group based project. [Attachment 7] All faculty commit five weeks of full-time work with GDEP, distributed over the eight weeks of full-time work for which the students are paid and held responsible. All student participants must prepare poster presentations of their research and give them at a culminating on-campus student research symposium (the campus holds a symposium for a number of somewhat similar research immersion programs in various science disciplines). They are encouraged to give posters at regional science conferences as well, for which travel and registration moneys are provided from GDEP.

[Attachment 8] In summer 2002, we ran seven GDEP research projects. These covered quite a diverse range, given the varied interests of the three disciplines involved. There were three geological projects focussed on local sedimentary and structural geology of both marine and terrestrial environments and a tectonic geomorphology project in Mexico. Two projects focussed on geoarchaeological prospecting in Malibu Creek State Park and on the Channel Islands, which each involved an archaeologist, a geologist, and a geographer. [Attachment 9] A seventh project involved students with the ongoing chaparral fire hazard

analyses of the NASA Regional Earth Science Applications Center housed in the Department of Geography.

[Attachment 10] In addition to lab and field work on these seven projects, the student participants were also provided a program of on-campus workshops and off-campus tours designed to enhance their research and study skills, give them new and highly sought skills in presentation techniques and web design, ensure that they understood field and lab safety requirements, expose them to GIS, GPS, and remote sensing, and introduce them to the ethics of scientific work.

GDEP Assessment

[Attachment 11] A very important aspect of GDEP is assessment of the degree to which it accomplishes its goals. To that end, one of the assessment projects involved establishment of a baseline of general education student perceptions of the geosciences. This entailed surveys distributed to sections of each department's basic general education science course. These surveys were administered at the beginning of each class to establish how students viewed the geosciences before having taken the introductory course and then at the end of the semester to see how the course had affected their perceptions. The survey consists of 25-30 questions to be answered along 1-5 point Likert scales ranging from strongly agree to strongly disagree. [Attachment 12]The first round of these ongoing surveys were conducted at CSULB during the spring of 2002, before any of the GDEP faculty had gone through the first GDEP summer. In the pre-test, three-fourths of student answers to the questions diverged significantly from a neutral answer of 3 (though rarely as much as 1 point away). Roughly half their answers indicated positive feelings towards the geosciences and a quarter were negative. The post-tests showed a slight but non-significant increase in positive perceptions.

GDEP plans to administer these surveys over the three years of the project to see if faculty participation in GDEP summer activities will affect their teaching enough to produce significant improvement in non-GDEP student perceptions of the geosciences in their classes. The surveys were, accordingly, readministered in Fall 2002, but only in geography were both pre- tests and post-tests completed.

[Attachment 13] Results remain disappointing at this stage. Sixty percent of student pret-test responses diverged significantly from neutral, with positive and negative divergences roughly equal at 32% and 28%, respectively. In the post-tests, only half diverged significantly from neutral, with positive divergences down slightly to 30% and negative divergences down a bit more, to 20%. In all, student perceptions basically became overall more neutral. We hope to improve these results and are in the process of doing pre-test and post-test surveys in the classes of participating community college and high school faculty.

[Attachment 14] Those students who participated in GDEP activities were the subject of more intense and more qualitative assessments. Dave Whitney conducted pre- GDEP focus groups with the 7 students who started GDEP of the 8 students originally selected. He then conducted post-GDEP focus groups with the 5 students who completed the program, and then they participated in a debriefing session with all faculty after the culminating poster session.

[Attachment 15] The students strongly commended the opportunities they had to work one-

on-one with faculty, graduate students, and their peers and get to know them as individuals while engaging in their research and workshops. They reported coming to an understanding of why math and physics are so often recommended or required of the sciences in general and the geosciences in particular as students worked on their own data. They were also impressed with the kinds of jobs that geographers, geologists, and archaeologists do and the good pay they earn and commented that this came as something of a surprise for them. Very tellingly, the students often remarked on how obviously factionalized the disciplines seemed at their home institutions: They were surprised at the pleasant atmosphere of cooperation among CSULB geographers, geologists, and archaeologists participating in GDEP. The students all left with a commitment to the geosciences, all but one planning to major in one of them (mostly geology this time around) and that one planning to minor. All of them now want masters and doctoral degrees, aspirations much elevated from their goal of getting bachelors or masters degrees on entering the program.

Conclusions

[Attachment 16] GDEP's first year boasts many successes. The CSULB geologists, geographers, and archaeologist succeeded in creating a collaborative community among themselves that could design multidisciplinary goals and work to get them implemented through a complicated intracampus and intercampus institutional structure. This collaborative eventually included 9 community college and high school faculty and 15 CSULB faculty, graduate students, and staff, as well as the 5 successful interns. GDEP incoporated assessment from the very beginning, not just of the GDEP projects themselves, but of the impacts that GDEP will have on large numbers of non-GDEP students in participants' classes. GDEP has already resulted in 4 presentations in geography and geology conferences, besides the 2 being presented here at the AAG. The first of the research reports themselves is being reported by Suzanne Wechsler in a 1 pm session tomorrow. GDEP maintains an active web presence where its research projects are outlined and its products are archived.

[Attachment 17] GDEP has faced a number of challenges, however, which we are working to resolve for the Summer 2003 season. We have funding to support 10 GDEP interns each summer, but were only able to recruit 8 last summer, of whom only 5 stayed throughout the summer. We found that, because of the interdisciplinary tensions noted by the students, we cannot rely on approaching one faculty member at each partner institution and having them contact their colleagues in the other disciplines on campus. We are, thus, engaging, in one-on-one contacts with all faculty in the three disciplines on each campus, visiting the campuses to explain GDEP and encourage faculty to recruit for GDEP and consider participating themselves. We found that, despite an introductory meeting with student applicants and their nominees last year, a lot of the interns did not really understand that GDEP is a full-time job for 8 weeks and that field work can be quite demanding. We are remedying this by offering a one day field "boot camp" before student applicants commit to GDEP, hoping this minimizes attrition this summer.

We are continuing to expand our assessment surveys to all general education science courses we teach, both us at CSULB and those at the partner community colleges and high schools. We also would like to know more about the general student population perception of the geosciences, so we are going to institute focus groups in the general student population to get a more nuanced and qualitative sense of student perceptions of the three disciplines and personal obstacles to considering them as majors.

[Attachment 18] In short, we encourage geographers in other minority-serving institutions to consider seeking out their colleagues in geology and archaeology. Research-based experiences for underrepresented groups in your own and neighboring feeder institutions are one means of increasing minority student interest in the geosciences. NSF has funds earmarked for such programs in the Geosciences Directorate. Such interaction can be terrifically rewarding, improving the contacts among disciplines, boosting your own individual research activities, as well as getting a new group of students interested in our disciplines.

Attachment 1

Geoscience Diversity Enhancement Project: Student Responses

Christine M. Rodrigue, Suzanne Wechsler, David Whitney, Elizabeth L. Ambos, Maria-Teresa Ramirez-Herrera, Richard Behl, Robert D. Francis, Daniel O. Larson, and Crisanne Hazen

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Attachment 2

GDEP -- Geoscience Diversity Enhancement Program

- Three-year program - began in Fall 2001
- Funded by the National Science Foundation's Opportunities to Enhance Diversity in Geosciences program (OEDG)
- Designed to attract students from NSF- designated underrepresented groups in Science, Technology, Engineering, and Math (STEM): African-American, Latino, Native American, Pacific Islander, and disabled students
- Geosciences defined as: studies in the physical geographic, geologic, archaeologic, and environmental science disciplines.

Attachment 3

GDEP: An Interdisciplinary Partnership to Improve Opportunities for Students

- A unique teaming among CSULB faculty in geography, geology, and anthropology
- Three departments and two colleges collaborated to provide interdisciplinary Earth system science research opportunities for community college and high school students on the CSULB campus
- Designated partners include 5 local community colleges and the Long Beach Unified School District
- Dedicated to closing the GAP between community demographics and 4-year college geoscience student demographics

Attachment 4

Student Enrollment, F/2000 NSF-Defined Underrepresented Groups

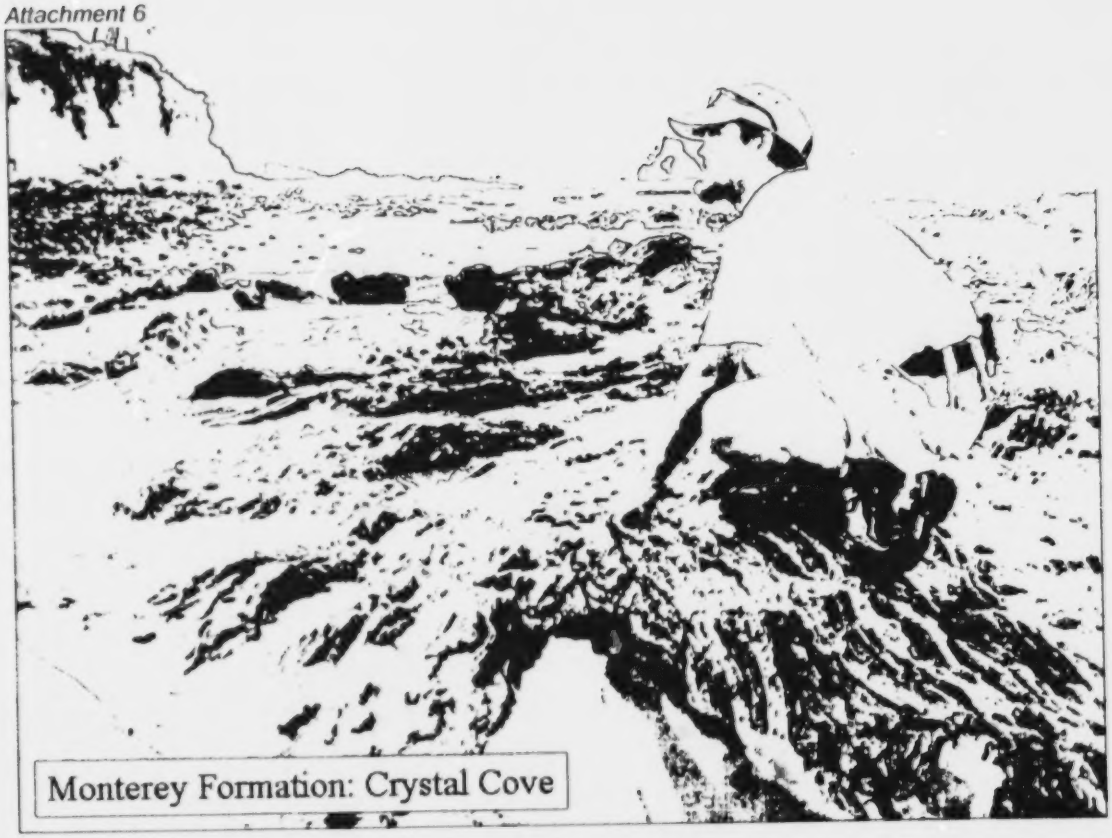
NSF "STEM" ethnicities	CSULB	GEOG + GEOL	LBUSC
Native American	0.7	2.2	0.4
African American	6.6	2.2	19.9
Latino/Hispanic	21.1	8.6	43.8
Pacific Islander	0.5	0.7	2.1
Other Groups	6.4	86.3	33.7
Decline to Respond	8.7	0.0	0.0
TOTAL	100	100	100

Attachment 5

GDEP: Goals

- A unique teaming among CSULB faculty in geography, geology, and anthropology
- Increase number of underrepresented students with geoscience educational and research experience
- Create seamless transition of underrepresented students from community colleges and high schools into geosciences majors at the university level
- Increase awareness of community college and high school students of the geoscience fields, their career opportunities, and educational requirements
- Enhance the quantity and quality of geoscience research and teaching materials by faculty members from the university, community colleges, and high schools
- Increase the number of geoscience majors who are retained in their disciplines

Attachment 6



Monterey Formation: Crystal Cove

Attachment 7

GDEP: Collaborative Research Activities

- 7 projects involving faculty in geography, geological sciences, and archaeology
- 1 assessment project involving a faculty member in psychology
- 8 weeks of laboratory and field activities during Summer 2002
- 100% time commitment by students
- 66% time commitment by faculty
- Students prepared posters describing their research for a campus research colloquium in August 2002

Attachment 8

GDEP: Seven Projects

- Sedimentary geology of the San Joaquin Hills Monterey Formation (Orange County, CA)
- Structural geology of deformation bands in the San Joaquin Hills of Orange County, CA
- Marine geology and geophysics of the offshore Palos Verde Fault (Southern California)
- Pacific Coast of southern Mexico: Active tectonics
- Pre-excavation geoarchaeological assessment of California Channel Island Chumash sites
- Geophysics and GPS: Mapping Malibu Creek Adobe
- Chaparral fire hazard analysis using remote sensing, live fuel moisture field data collection, GPS, and GIS

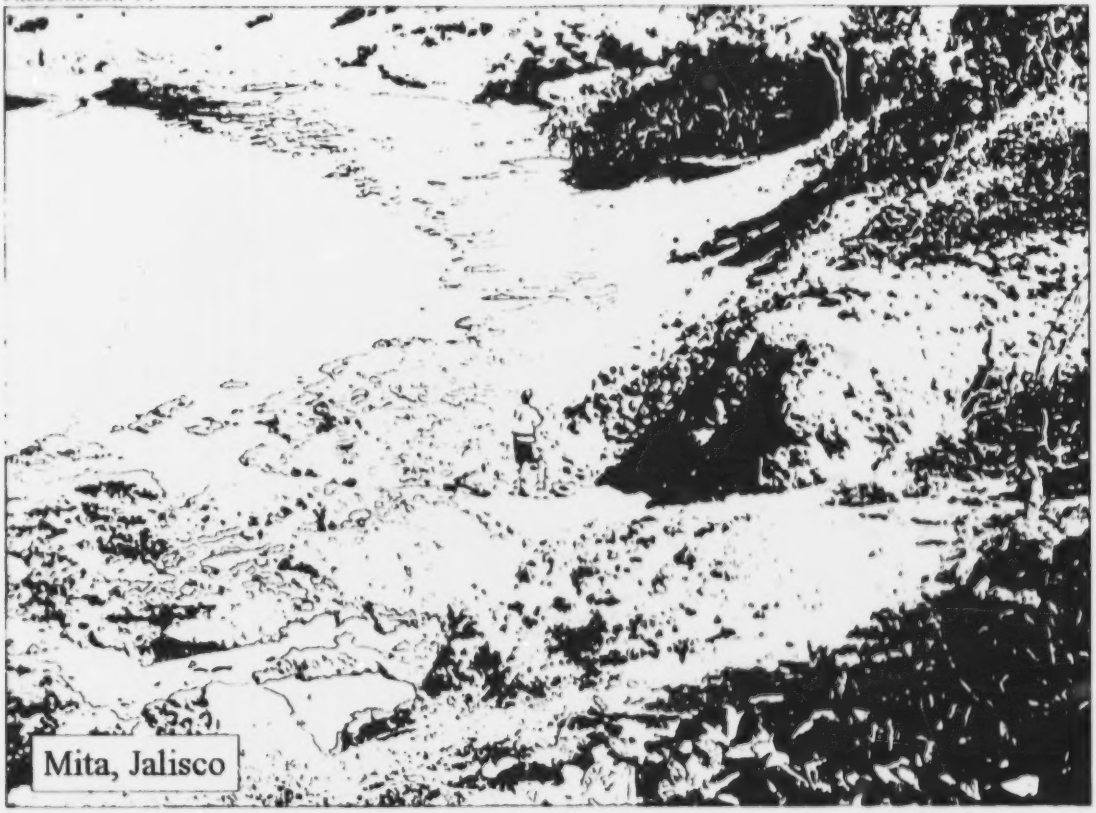
Attachment 9

Attachment 10

GDEP: Summer Enrichment Workshops on Campus

- Library skills and resources
- Laboratory and facility tours
- Lab and field safety
- Scientific ethics
- Jobs in geography and geology
- GPS, GIS, and remote sensing
- Presentation software (PowerPoint)
- Web design (HTML and FTP)
- Poster preparation for scientific conferences

Attachment 11



Attachment 12

GDEP: A Baseline of Student Views of the Geosciences

- Pre-test survey was done in S/02 in Geography (n=41), Geology (n=20), and Anthropology (n=15) GE science courses, followed by post-test to establish student perceptions of geoscience before GDEP's first summer (n=76)
- Pre-test: 76% of questions diverged significantly from neutral, 48% in a positive direction
- Post-test: 76% of questions diverged significantly from neutral, with 57% now positive, but there is no significant difference between the pre-tests and the post-tests

Attachment 13

GDEP Student Surveys: Focus on Geography

- In F/02, the surveys were re-administered. Only geography did both pre- and post-test surveys (n=20)
    - Pre-tests showed 60% of answers to be significantly different from neutral; 32% positive, 28% negative
    - Post-tests showed 50% of answers to be significantly different from neutral; 30% positive, 20% negative
    - There seems to be a convergence toward neutrality
- There is, as yet,little improvement in student perceptions of the geosciences, including geography
- GDEP hopes to alter our own p&alig;dagogy to improve these figures over the three years of the project

Attachment 14

Attachment 15

GDEP: Student Interns' Experiences

- Focus groups were conducted after GDEP to assess its impact on the 5 interns who completed GDEP
- Students liked individual interactions with university faculty, the field activities and workshops, and camaraderie with peers and CSULB grad students
- They reported seeing why math, physics, and computers are important from applications in GDEP
- They were impressed with geoscience-related jobs
- Students commented on positive relations among the 3 disciplines at CSULB and noted divisiveness in some of the community colleges
- All students now want masters and doctoral degrees; all but one want to major in a geoscience and the one plans a geoscience minor

Attachment 16

GDEP: First Year Progress

- Created scholarly community and collaborative process to design and carry out project goals
- 5 students completed research projects
- 9 community college and high school faculty participated
- 15 CSULB faculty, staff, and graduate students participated
- Created and implemented evaluation plan
- Institutionalized assessment of geoscience student learning outcomes outside the GDEP projects

- Dissemination in 4 presentations in geography and geology conferences by December 2002 and by the Web -- http://www.csulb.edu/geography/gdep

Attachment 17

GDEP: Challenges for 2003

- Increase number of student and faculty applicants
  - Doing recruitment talks on CC and HS campuses
  - Approaching all CC geoscience faculty, because the one-contact model fell afoul of interdisciplinary politics on the CC campuses
- Clarify summer research expectations before GDEP starts
  - 3 GDEP dropouts were overwhelmed by field work
  - 1 of them did not realize that GDEP is a full-time job
  - We are instituting a field boot camp before student selection
- Expand scope of evaluation
  - We are instituting pre-test/post-test surveys in all GDEP faculty lower division courses to monitor changes in our instructional effectiveness after GDEP experience (CSULB, CC, and HS)
  - We are going to start focus groups in those classes to get qualitative data on benefits to non-participating students due to GDEP

Attachment 18

Geoscience Diversity Enhancement Project: Student Responses

Christine M. Rodrigue, Suzanne Wechsler, David Whitney, Elizabeth L. Ambos, María-Teresa Ramírez-Herrera, Richard Behl, Robert D. Francis, Daniel O. Larson, and Crisanne Hazen

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